



**Vel Tech**  
Rangarajan Dr. Sagunthala  
R&D Institute of Science and Technology  
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**International E - Conference**

**on**

**NOVEL INNOVATIONS AND SUSTAINABLE  
DEVELOPMENT IN CIVIL ENGINEERING**

**NISDCE'20**

**June 13 & 14, 2020**

**CONFERENCE PROCEEDINGS**



*organized by*

**DEPARTMENT OF CIVIL ENGINEERING  
SCHOOL OF MECHANICAL AND CONSTRUCTION**

*in association with*



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### About the Institute

Vel Tech is well-known for its renowned educational practices, which has been recognized and endowed with several awards. The founders of the Institution, Col. Prof. Vel. Dr. R. Rangarajan, Chancellor & Founder President and Dr. Sagunthala Rangarajan Foundress President believe in Education for All despite their financial means which will promote and uplift the society. In accord to their vision, Vel Tech Mahatma Gandhi Scholarship scheme was started and has supported students since the inception. Vel Tech has bestowed 9500 scholarships worth approximately Rs. 35 Crore until 2019.

### About the Department

The Department of Civil Engineering started in the year 2009, offers B.Tech. Programme, M.Tech. Programme, Research and Consultancy. The P.G. Programme has four disciplines; Structural Engineering, Environmental Engineering, Construction Engineering and Management and Geotechnical Engineering which are industry oriented. The Department has 33 Faculty Members (most of them with Ph.D. qualifications) augmented with many visiting professors from reputed Institutions like IITs, NITs and International Universities. The department has been accredited by NBA for 3 years, effective from 2018. Most of the faculty members are fellow and member of professional bodies in various fields of Civil Engineering covering the areas of concrete, soil mechanics, water resources, remote sensing, etc. Faculty members and Students continuously update their knowledge by attending training programmes at IITs, IISc and other premier Institutions. Active participation of the faculty members in research, consultancy services & sponsored research activities helps them to interact with industries and demonstrate the application of concepts in field and improve the teaching learning activities of the department.

### About the Conference

The Two-Day International E-Conference on Novel Innovations and Sustainable Development in Civil Engineering (NISDCE'20) aims to confabulate the endurance of structures and innovative ideas for the sustainable development of civil infrastructure projects. Eminent professors of various Universities from India and abroad will deliberate at different themes. The conference invites innovative, economic, environmental and social measures which are need of the hour for the development of the New India.

### CONFERENCE THEMES

- Structural Health Monitoring
- Composite Structures
- Light Weight Structures
- Reclaimed Building Materials
- Advancements in Construction Techniques and Materials
- Construction Management
- 3-D Printing
- Earthquake Engineering
- Earthquake Geotechnics
- Transportation Engineering
- PavementGeotechnics
- Soil Behaviour
- Soil Reclamation
- Foundation Engineering
- Ground Improvement Techniques
- Application of Remote Sensing and GIS
- Asset Mapping
- Water Resources and Water Quality Management
- Advanced Water and Wastewater Treatment
- Prevention of Ground Water Contamination
- Rain Water Harvesting
- Solid and Hazardous Waste Management
- Assessment and Control of Air Pollution

## EVENT SCHEDULE

DAY 1 (13.06.2020)



9.30 AM to 9.45 AM

Inaugural Session  
Welcome Address &  
About the Conference



10.00 AM to 10.50 AM

Technical Session - I  
**Dr. Raju Aedla**  
Research Scientist  
Kumamoto University, Japan.



11.00 AM to 11.50 AM

Technical Session - II  
**Dr. A. R. Santhakumar**  
Emeritus Professor  
IIT Madras, Chennai.



12.00 PM to 12.50 PM

Technical Session - III  
**Dr. G. Appa Rao**  
Professor - IIT Madras, Chennai.



01.30 PM to 02.30 PM

Technical Session - IV  
**Dr. D. V. Reddy**  
Professor (Rtd.) - NITK Surathkal



02.45 PM to 04.30 PM

Technical presentation by  
participants  
(3 parallel sessions -10 participants  
per session based on domain)

## EVENT SCHEDULE

DAY 2 (14.06.2020)



10.00 AM to 10.50 AM

Technical Session - I  
**Dr. Huang Lungmao**  
Feng Chia University, Taiwan



11.00 AM to 11.50 AM

Technical Session - II  
**Dr. N. Ganesan**  
Professor (Rtd.) - NIT Calicut



12.00 PM to 12.50 PM

Technical Session - III  
**Dr. K. S. Sathyanarayan**  
Professor & Head/Civil - SRMIST



01.30 PM to 02.30 PM

Technical Session - IV  
**Dr. R. Senthil**  
Professor & Head - Structural Engg.,  
Anna University, Chennai.



02.45 PM to 04.30 PM

Technical presentation by  
participants  
(3 parallel sessions -10 participants  
per session based on domain)



4.30 PM to 5.00 PM

Valedictory Session  
Vote of Thanks

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## EXPERIMENTAL STUDY ON FLEXURAL STRENGTH OF ALCCOFINE REINFORCED CEMENT CONCRETE PRISM WITH STEEL FIBER

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<sup>2</sup> Assistant Professor, University College of Engineering, Nagapattinam, Tamil Nadu.

**ABSTRACT:** This Experimental work deals with the effects of alccofine, by optimum replacement of cement with variation of steel fiber on flexural strength. In this study 42 prism samples of size 500 x 100 x 100mm were cast by 10% of alccofine with different percentage of steel fiber 1%, 2%, 3%, 4% and 5% respectively. From the test results, it was found that workability of the mix was slightly decreases compared with the conventional mix due to high bonding of steel fiber in it and slump curve is plotted. The flexural strength of concrete with 10% of alccofine and 5% of steel fiber has higher strength when compared to the conventional concrete and graph was plotted and it was found to be increasing manner. Load displacement curve was drawn and from the curve it was found that initial crack strength and ultimate flexural strength was found to be increasing with increasing volume of fibers. Provided best fit model was developed for all the mixes which are under cured after 7 days and 28 days curing.

**Keywords:** Alccofine, Flexural Strength, Steel Fiber

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## EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES OF CONCRETE ELEMENTS USING AGRO WASTE AS REPLACEMENT FOR FINE AGGREGATE

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**ABSTRACT:** In every civil engineering activities, concrete is the predominant material which is effectively applied for the construction of sub-structure and super structure. The rapid development of urbanization and industrialization has depleted the more natural resources. The disposal of these natural resources which are obtained from agricultural activities creates a boom to the environment. The availability of the river sand also gets decreased in day to day construction life; hence agro waste is used as replacement for river sand. In the present study, the agro wastes such as coconut shell powder (CNS), rice husk ash (RHA), saw dust (SDA) are equally proportioned to the weight of the fine aggregate. The varying proportions (2%, 4%, 6%, and 8%) of agro waste to the weight of fine aggregate are taken for experimental investigation. Agro waste concrete is compared with the conventional concrete for the improvement of strength characteristics and also the performances are determined by non-destructive testing. The optimization of the concrete is obtained based on mechanical properties of concrete. The results obtained give the stability of the agro waste concrete to apply in civil engineering applications.

**Keywords:** Agro waste concrete, Strength properties, Non- destructive testing.

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## EVALUATION OF DROUGHT RISK ASSESSMENT BASED ON SOIL MOISTURE IN KANCHIPURAM DISTRICT, TAMILNADU, INDIA - A GIS APPROACH

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**ABSTRACT:** Droughts are one among the major and unpredictable disasters. The impacts are categorized as agricultural, meteorological, hydrological and socio-economic. They affect the major regions and cause tremendous effects both naturally and artificially. The present study deals with the evaluation of drought based on different drought Indices with a GIS perspective. One of the key variable factor in the study is soil moisture which alters the climatic and hydrologic factors. To aid the study, the soil moisture is analyzed through gravimetric analysis and Arduino software. The software determines both analytical and digital outputs. Spatial and Non Spatial data were also collected to uplift the accuracy of soil moisture. The study was aimed at the comparison of spatio-temporal variations of the soil moisture and the drought risk assessment drought using composite drought indices.

**Keywords:** Drought, Soil Moisture, GIS, Spatio-Temporal Variation, Drought Indices

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**ASSESSMENT OF GROUND WATER QUALITY BY USING WATER QUALITY INDEX AROUND AJITHSINGH NAGAR DUMP YARD IN VIJAYAWADA, ANDHRA PRADESH, INDIA.**

**Bharthavarapu srikanth<sup>1</sup> geetha selvarani a<sup>2</sup>  
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**ABSTRACT:** Water is an essential natural resource for sustaining life and environment but over the last few decades the water quality is deteriorating due to its over exploitation. Water quality is essential parameter to be studied when the overall focus is sustainable development keeping mankind at focal point. Groundwater is the major source of drinking water in rural as well as in urban areas and over 94% of the drinking water demand is met by groundwater. The study was carried out to assess the ground water quality and its suitability for drinking purpose around the ajith singh nagar dump yard of Vijayawada, Andhra Pradesh. For this purpose, water samples were collected in ajith singh nagar, nunna, payakapuram, kandrika, rajiv nagar areas around dump yard and analyzed for different physio-chemical parameters such as pH, turbidity, total hardness, chloride, total dissolved solids, total alkalinity, fluoride, sulphates, nitrate, and iron. We assessed ground water quality in terms of WQI of those areas by using weighted arithmetic water quality index formula. It shows that WQI of ajith singh nagar, nunna, payakapuram, kandrika, rajiv nagar areas have poor ground water quality and undesirable for drinking purpose.

**Keywords:** Groundwater Quality, Physio-Chemical parameters, Statistical Parameters, WQI

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## IMPROVING THE SHEAR STRENGTH BEHAVIOUR OF SOIL USING RUBBER TYRE WASTE

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<sup>2 & 3</sup> Assistant Professor, St. Joseph's College of Engineering, Chennai, Tamil Nadu.

**ABSTRACT:** Construction of engineering structures on weak or soft soil is considered as unsafe. Improvement of load bearing capacity of the soil may be undertaken by a variety of ground improvement techniques. In the present investigation, powdered rubber from waste has been chosen as the stabilizing material and cement as binding agent which was randomly included into the soil at different percentages of rubber tyre content, i.e. 2% 4% 6% 8% and 10% by weight of soil. The tyre waste used in this study was metal strip removed. The investigation has been focused on the strength and CBR behavior of soil with randomly included powdered rubber. Initially the Virgin Soil is tested for Index Properties to Classification of Soil. By conduction Soil Classifications test, it is categorized as High Plasticity Clay (CH). Then the Virgin soil and stabilized samples were tested for California bearing ratio and Unconfined compression tests. The test results obtained are compared with virgin samples and inferences are drawn towards the usability and effectiveness of rubber tyre waste. The low strength and high compressible soft clay soils were found to improve by addition of powdered rubber and cement. It can be concluded that powdered rubber tyre can be considered as a good stabilizing material.

**Keywords:** High Plasticity Clay, Rubber Tyre Waste, Soil Stabilization, Shear Strength and CBR

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## A STUDY ON THE BEHAVIOUR OF DEEP BEAMS REINFORCED INTERNALLY WITH HYBRID FIBRE REINFORCED POLYMER WITH AND WITHOUT WEB OPENINGS

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**ABSTRACT:** The use of non-corrosive reinforcements in the place of steel reinforcements has therefore been focused as an alternative to improve the life span of the concrete structures. Fibre Reinforced Polymer (FRP) reinforcements offer many advantages over steel reinforcements including resistance to electrochemical corrosion, high strength to weight ratio and easy in fabrication and electromagnetic insulating properties. Further, the use of hybrid FRP reinforcements, in lieu of conventional steel reinforcements requires better understanding under different parametric conditions. Therefore the present study deals mainly with the behavior of Concrete Deep beams with and without openings reinforced internally with hybrid type Fibre Reinforced Polymer (FRP) reinforcements under static loading conditions. In this study concrete deep beam with and without web openings are investigated. Among the eight beams, four beams are reinforced internally using conventional reinforcements with and without web openings, four beams are reinforced internally using hybrid FRP reinforcements with and without web openings. Different parameters like strength of concrete, web opening positions, span sprinkled FRP hybrid reinforcements are considered. Based on this study, static load carrying capacities and their modes of failures of deep beams reinforced internally with FRP hybrid type reinforcements for various web openings positions are compared with the existing theories for better under standings. Based on the experimental and analytical work, final conclusions of the present study are derived.

**Keywords:** Fibre Reinforced Polymer(FRP) Hybrid Reinforcements, Deep beams, Static Loading, Web Openings, Shear Span to Depth Ratio

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## STRENGTH INVESTIGATION ON STABILIZED SOIL USING QUARRY DUST (QD) AND PHOSPHOGYPSUM (PG)

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**ABSTRACT:** This research is aimed at achieving effective utilization of stabilized soil as a sustainable building material by improving its strength using Quarry Dust (QD) and Phosphogypsum(PG). Quarry Dust is an industrial waste obtained from stone crushing/rock Quarries. Quarry Dust is used as an effective admixture to stabilization of expansive soil. Phosphogypsum (PG) is the industrial by-product of phosphoric acid production, needed for manufacture of fertilizer, from phosphate ore. This study compares the effect of Quarry Dust and Phosphogypsum on the stabilization of soil at different proportions. The stabilization process was amended with four different content by using 0%,2%,4%,6% and 8% of QD and PG. The effect of stabilizer on soil properties, Standard Proctor were studied.

**Keywords:** Soil Stabilization, Phosphogypsum, Quarry Dust, Optimum Moisture Content, Maximum Dry Density

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## A CASE STUDY OF SUCCESSFUL BIM IMPLEMENTATION FOR CONSTRUCTION COMPANY IN TAIWAN

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**ABSTRACT:** Implementing BIM (Building Information Modeling) technique in construction industry has attracted huge attentions globally. Previously, key success factors for BIM implementation have been identified; including BIM related education, top management level support, key BIM manager, Industry-University cooperation, etc. Based on the experience of implementing BIM in Taiwan, most construction companies suffer a common problem of obtaining skilled BIM engineers. Therefore, to provide the best practice from successful companies with good business strategies is beneficial to the companies that are willing to implement BIM to improve their service qualities. This study reported a case study by conducting expert interviews and a questionnaire survey on BIM engineers in a successful company in Taiwan. By the outcomes of expert interviews, the key success factor of BIM implementation in a construction company is education and training on engineers. Furthermore, the company provides internship for the students in BIM training programs that makes up the lack of experience for fresh graduated students, and provides higher salaries to attract and to retain BIM engineers. It is obvious that the students in the BIM training programs are willing to join the study company after graduation. Based on a questionnaire survey of BIM engineers in the study company, this study identifies several valuable factors for successful BIM implementation in the study company, including the BIM engineers trained with industry mentors from the study company having lower turnover rate, the main reason of BIM engineers leaves being unsatisfied salary, and the BIM engineers with good and correct experience increasing their competitiveness. The outcomes of this study provide valuable findings for the company and the university that target on implementing BIM technique in their operations and education systems.

**Keywords:** *BIM, BIM education, Key Success Factors, BIM Engineers, Taiwan*

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## ANALYTICAL STUDY OF HYBRID TRC WITH ENGINEERED CEMENTITIOUS COMPOSITES

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**ABSTRACT:** Textile reinforced concrete (TRC) is a type where instead of steel reinforcement, textile is been used to provide strength in the tensile region of the concrete. Basically TRC will have a single woven fiber mesh as reinforcing material; in this study two fiber material are woven together making it a hybrid mesh which is the combination of carbon and Kevlar fiber. The cement matrix used is known as engineered cementitious composites (ECC) which is similar to the fiber reinforced concrete (FRC) but without coarse aggregates. this study focuses on thin shell reinforced with carbon-kevlar hybrid textile mesh considering 3, 4 and 5 layers of the mesh and also for different grades of concrete. Their load carrying capacity and stress-strain behavior is been studied using FEM software. In the analytical investigation, it was observed that load and deflections varies accordingly based on the grade of concrete and layers of the hybrid mesh. Considering all the cases, 5 layers of hybrid TRC having the concrete grade of M40 was determined to be optimum having more strength capacity.

**Keywords:** ECC, Hybrid, mesh, Textile, Thin shell

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## BIM APPLICATION AND CASE STUDY IN TAIWAN

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**ABSTRACT:** BIM is a tool which helps to build a model by integrating all the designs like Structure, architecture and MEP which prevents any kind of design issue. BIM is a package of different software like Revit, Navisworks, Micro station, Tekla, ArchiCAD and so on. It is also known as digital representations of physical and functional characteristics of construction works. In other word we can say it is a process for designing and documenting information on buildings. BIM technology is one of the emerging technologies in different part of world. Despite its short history, BIM has had an increasing growth during the last decade. This is happening mainly due to its capabilities on construction projects. Many designs issue can be solved in pre planning phase by help and use of BIM technology. The BIM model provides platform for information integration. It is helpful for design evaluation and assist designer to verify drawing correctness and consistency. All kinds of information can improve project management level. Therefore, many enterprises are starting to adopt BIM tool, but some of them do not know the BIM series function clearly, because there is no more specific reference to use. This article resource is according to literature review from different references, such as conference and journal articles. The aim of paper is to analyze BIM application and to show so some practical cases of Taiwan to prove how BIM technology is help full for all type of construction industry. The case studies which are used in this paper are real case and self-experienced case of Construction Company in Taiwan.

**Keywords:** BIM, Integration, New technology, Case study Taiwan

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## ANALYSIS ON COST ESTIMATION OF AN EDUCATIONAL BUILDING (B+G+4)

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**ABSTRACT:** Estimation is the approximate costing of a project that helps investors to decide on the shares, client to allocate budget and contractors to forecast the budget of the project. Cost analysis is done at every stages of a project which is majorly categorized into two, types such as Initial capital cost, Operation and Maintenance cost. Cost consideration are continually present from starting to end of the project which includes design cost, project budget, procurement cost, operation cost, maintenance cost and demolition cost. Cost is the most important factor to be considered in the planning of every project. Cost estimation is the vital part of any construction project that comes under Initial capital cost. Success of the project depends solely on cost estimation. Cost estimation helps the project to be cost effective and to control budget overrun and therefore, it is essential to study and analyses causes of construction delay. It prevents project owner from losing money and helps to avoid overpaying of the project. Proper design and layout of building structure is needed to estimate the cost. Cost estimation is the governing part of the earned value management which tracks the project performance with total time and cost estimate. The aim of the project is to analyze the cost for the construction of educational building (G+4). The paper describes the basic forms of cost calculation for structures. The manual analysis of cost is done using Microsoft Excel sheet tool and the obtained results are compared with the bureaucratic values.

**Keywords:** Cost estimation, Microsoft Excel sheet tool, Educational buildings, Bureaucratic Values

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## MULTI CRITERIA DECISION ANALYSIS FOR INVENTORY MANAGEMENT

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**ABSTRACT:** Infrastructure development involves a huge number of raw materials for the construction which on proper management yields 2% to 3% profit. Nevertheless, there is a lack of proper inventory management system. Unlike other industry, in most cases, the stock manager of construction industry goes for very basic system of inventory management like paper keeping. This system proves to be very tedious when the inventory to be managed is more. After the development of computer systems and operational research, many number of inventory management software were developed. These software's run with some models to segregates the inventory item into some definite class for later management. The aim of this project is to find a suitable model that can categorize the construction inventories into three broad classifications and use it for further inventory management. In this project, the classification is based on multi criteria to prevent subjectivity of an item over single criteria.

**Keywords:** Multi-criteria, Inventory Model, Single Criteria, Inventory Management

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## EFFECTIVE RECYCLING AND UTILISATION OF C&D WASTE INTO SECONDARY CONSTRUCTION MATERIALS

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**ABSTRACT:** Total cost of housing construction, building materials contributes to more than 60% of cost in developing countries like India. The increase in the popularity and fashion of construction is growing big on a large-scale. The old structures are demolished to construct new and the solid waste accumulation turns to be higher in alarming rates. In addition the waste generated during the process of construction makes space run out in the sites and it needs to be evacuated. C&D waste collectively called as Construction and Demolition waste has evolved itself as a great threat by polluting the environment and ecosystem. Moreover, the natural resources and materials are depleting quickly, where production of new materials also causes pollution and paves way for Global Warming. Hence a proper method shall be employed in reducing the generation of the waste. This could be achieved by adopting a proper planned progressive systematic approach in recycling the generated debris. To avoid the depletion of the natural resources and reduce the pollution to a considerable quantity, the waste generated in Construction and Demolition process shall be recycled. It shall be achieved by removing the shortcomings in recycling process. A clear comparative study on the parameters based on physical and mechanical properties shall be done extensively in determining the strength properties of aggregates. A final conclusion shall be arrived based on the obtained results.

**Keywords:** *Construction and Demolition Waste, Recycling Process, Strength Properties, Global Warming, Utilizing Waste, Recycled Coarse Aggregate*

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## ULTIMATE BEHAVIOUR OF PRESTRESSED CONCRETE SEGMENTAL BOX GIRDER BRIDGES

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**ABSTRACT:** Deployment of pre-stressed concrete box girder bridges has become increased day by day in highways and railways of the most developed countries including India. The advantages namely fast construction, no disruption at ground level, high controlled quality have made the box girder as best choice for bridges. Especially, the segmental box girder bridges offer easy and fast construction. METRO bridges, elevated highway bridges and sea-links are constructed using segmental box girders. However, there are many parameters need to be studied in detail to understand the ultimate behavior of pre-stressed box girders. They are namely stress increment in tendons, plastic hinge length, ductility and joint behavior of segmental box girder. This paper intends to review critically the ultimate behavior of box girders of both monolithic and segmental types and summarize the issues.

**Keywords:** Box Girder, Segmental, Cast in Place, Joints, Flexure, Stress in Tendons

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## REVIEW ON MECHANICAL PROPERTIES OF CONCRETE WITH REPLACING CURING WATER BY SELF CURING COMPOUNDS

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**ABSTRACT:** The curing of concrete requires large amount of water. Self-curing concrete is one type of concrete, which cure itself by retaining water (moisture content) in it. A body of literature on the different self-curing compounds is used for curing purpose without externally curing the concrete is currently available, but a systematic review is lacking. Therefore, this paper reviewed the published literature on the use of different self-curing compounds in concrete and past work analysis on self-curing concrete. Various chemicals were used to attain this curing. It was found out that various chemical admixtures such as Poly Ethylene Glycol (PEG), Sodium Lignosulphonate, Polyvinyl alcohol (PVA), Super Absorbent Polymer (SAP) and naturally available and commonly used materials like Light Weight Aggregates, Wood powder and Light Expanded Clay Aggregate were used to fabricate self-curing concrete. This paper summarizes the collected literatures on replacement of curing water with self-curing compounds and how these affects the fresh properties like workability and hardened properties like Compressive strength, Split tensile strength and durability of concrete.

**Keywords:** *Self Curing Compound, PEG, Super Absorbent Polymer, Polyvinyl Alcohol, Light weight aggregates*

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## A REVIEW OF APPLICATIONS OF 3D PRINTING IN CONSTRUCTION INDUSTRY

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**ABSTRACT:** The construction industry is constantly looking for new ways to improve project efficiency and profitability. Many new technologies such as Business Information Modeling (BIM), and project management software have been introduced to aid in preconstruction and on site coordination. However, traditional building methods have remained relatively unchanged for decades. 3D printing is a promising new technology that has the potential to not only be an effective means of increasing project efficiency, profitability, reduce time required, labor cost and wastage of materials in the field, but also have positive environmental impacts. However, as it exists today, this technology is highly limited by size, material, skilled labor, and industry reluctance. In this paper we have focused on introduction, applications, material used, advantages and disadvantages of 3D printing technology.

**Keywords:** BIM, Project Management, 3D Printing Technology

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## ENHANCING THE DURABILITY STUDY ON SUSTAINABLE CONCRETE WITH NANO SILICA AND CACTUS GEL

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**ABSTRACT:** Concrete has been a choice for the construction structures, in all zones such as cold regions and saline zone. However these environmental factors have made a critical damage effect on the concrete Structures. Consequently, this damage will decrease the servicing time of the concrete and Aesthetic view of construction within this environment. In order to evaluate the durability of concrete and the behavior of concrete specimens under the Acid attack, corrosion attacks was studied in this presented work .Nanotechnology is one of the most promising areas of science. The main use of nano particles in concrete is one of the new revolutionary steps in concrete technology. In this paper, an attempt has been made to understand the influence of Nano- silica and cactus gel to increase durability in concrete. An experimental investigation has been carried out to determine the and Durability tests such Acid attack and sulphate attack and Corrosion Test on normal cement concrete and concrete containing Nano-Silica and cactus gel .The ratio mixes were calculated from design code using IS 10262-2019, it can be expected that Nano-Silica and cactus gel should give the improve performance over durability effect.

**Keywords:** Nano Silica, Cactus Gel, Acid Attack Test, Corrosion Attack Test

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## COD REDUCTION IN TREATMENT OF SEWAGE WATER USING MICROORGANISMS

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**ABSTRACT:** In India the effluent and sewage discharged from industries and urban settlements are the major source of pollution of surface water bodies like rivers, lakes, wetlands etc. resulting in their environmental degradations. Therefore proper collection, treatment and disposal of industrial wastes and domestic sewage is an essential pre-requisite for conservation of aforesaid natural water bodies in order to maintain their environmental sustainability which is also related to the general health of the public and the improvement of quality of life. As per study carried out in 2003-04 by Central Pollution Control Board (CPCB), in India, the total waste water generation from class-I and class-II towns was 29000 million liters per day. Rainwater from roofs and roads may also drain into the sewer network. In this project work a study has been carried out on reduction of chemical oxygen demand (COD) in sewage water during its treatment process. The COD content in sewage water if left untreated, will reduce the dissolved oxygen in water bodies which ultimately results in the death of aquatic organisms. So in order to save the lives of aquatic organisms present in water bodies the COD content is reduced in sewage water. Various literatures are studied regarding the anaerobic treatment method using microorganisms to reduce the COD content in the sewage water. In the literatures microbes such as Aeromonas, Pseudomonas, Bacillus, Rhizobium etc reduces the COD content of the sewage water sample. Among that microbes which gives best efficiency is identified and it is used for reduction of COD in the sewage water through anaerobic treatment process here. Finally after the treatment process the treated sewage water COD content is compared with its standard limits and the results are discussed.

**Keywords:** Chemical oxygen demand(COD), Aquatic organisms, Dissolved oxygen (DO), Microbes, Anaerobic treatment

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## INFLUENCE OF NATURAL ORGANIC ADDITIVES WITH NANO INCLUSION IN CEMENT MATRIX COMPOSITES FOR SUSTAINABLE CONCRETE PRODUCT

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**ABSTRACT:** Nanotechnology is one of the most promising areas of science. The main use of nano particles is one of the new revolutionary steps in concrete technology. In this paper an attempt has been made to study the mechanical properties of concrete by using mineral admixture and natural organic additives. Concrete production requires huge amount of cement and aggregates which eventually increases carbon emission and contaminates environment. Hence fly ash is partially replaced for ordinary Portland cement. But usage of fly ash in OPC deviates concrete strength. Therefore Nano-silica is added as an admixture to draft the deviation, thereby improving the strength of concrete and organic additives such as cactus gel is used to increase the workability of concrete. In this experimental study the binding material cement were replaced by 60% and 30% of fly ash in a beam structure, with and without the usage of mineral admixture and natural organic additives. The comparison of mechanical properties of conventional concrete and concrete with admixtures is to be done.

**Keywords:** Nano-Silica, Cactus gel, Fly ash, Sustainable Concrete

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## COD REDUCTION IN TREATMENT OF SEWAGE WATER USING NATURAL COAGULANTS

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**ABSTRACT:** Domestic households, industrial and agricultural practices produce wastewater that can cause pollution of many lakes and rivers. Sewage is the term used for wastewater that often contains faeces, urine and laundry waste. There are billions of people on Earth, so treating sewage is a big priority. Sewage disposal is a major problem in developing countries as many people in these areas don't have access to sanitary conditions and clean water. Untreated sewage water in such areas can contaminate the environment and cause diseases such as diarrhea. Sewage in developed countries is carried away from the home quickly and hygienically through sewage pipes. In developed countries, sewage often causes problems when people flush chemical and pharmaceutical substances down the toilet. A study has been carried out on reduction of chemical oxygen demand in sewage water during its treatment process. The COD content in sewage water if left untreated will reduce the dissolved oxygen in water bodies which ultimately results in the death of aquatic organisms. To save the lives of aquatic organisms present in water bodies the COD content is reduced in sewage water. Coagulation treatment method using natural coagulant is the methodology which is adopted in this study to reduce the chemical oxygen demand in the sewage water.

**Keywords:** Chemical Oxygen Demand (COD), Natural Coagulant, Dissolved Oxygen (DO), Coagulation Process

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## SEISMIC ISOLATION OF RESIDENTIAL BUILDING

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**ABSTRACT:** Seismic Isolation of buildings has been practiced for centuries adopting different type of materials, such as sand, saw dust, wood, rubber and similar materials due to the significant advantages gained in the event of an earthquake. Nevertheless, seismic isolation is being identified as a modern or innovative technology; the fundamental concept of isolation is far from being a recent development. A significant number of buildings have been implemented with seismic isolation systems in one form or other. In the present study, a four story regular building located in Zone III and consisting of medium soil has been analyzed with and without seismic isolation system. The isolation has been implemented using Lead Rubber Bearing. The investigation shows that, when Lead Rubber Bearing is adopted, there is a substantial reduction in base shear and thereby the time period is elongated significantly. Therefore, seismic isolation system as adopted in the present study provides definite advantages in the event of an earthquake.

**Keywords:** Seismic Isolation, Time Period, Fundamental Frequency, Lead Rubber Bearing

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## **ANAEROBIC TREATMENT OF HIGH STRENGTH ORGANIC WASTEWATER FROM VTU CANTEEN USING HYBRID UPFLOW ANAEROBIC SLUDGE BLANKET (HUASB) WITH PLEATED PVC RINGS**

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**ABSTRACT:** Anaerobic treatment is generally used around the world as a Biochemical treatment for both domestic and industrial wastewater. The two main advantages of anaerobic over aerobic treatment is used for biogas production, which can be used as alternate fuel, and the lower rate of biomass production, which results in lower operation and maintenance costs for the plant. For the substrate, the processes included in the model are dispersion, advection and degradation of the organic matter in the substrate. The rate of reaction for the microorganisms includes the growth and decay of the microorganisms. The main objective of this project is to treat the high strength organic wastewater using hybrid up flow anaerobic sludge blanket (HUASB) reactor. In particular, the Physico-chemical characteristics of the high strength organic wastewater such as pH, Alkalinity, Total suspended solids (TSS), Biochemical oxygen demand (BOD), Total Chemical Oxygen Demand (TCOD), Soluble Chemical Oxygen Demand (SCOD), Volatile fatty acids (VFA) and Methane production is tested in the college laboratory itself and based on the output characteristics of sample, the amount of methane generation from the sample to be determined. The HUSAB is fabricated and wastewater is fed through the inlet port. The HUASB will be operated at different organic loading rate (OLR) and the maximum methane generation achieving rate will be determined while treating the high strength organic waste wastewater. The treated wastewater parameters will be monitored and the level of improvement of quality from raw effluent to treated effluent and maximum methane production will be determined. It will be made sure that the treated wastewater parameters shall meet the effluent discharge quality standards.

**Keywords:** Organic Loading Rate (OLR), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Chemical Oxygen Demand (SCOD)

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## EFFECT OF ORGANIC LOADING RATE ON POWER PRODUCTION POTENTIAL OF DUAL CHAMBERED MICROBIAL FUEL CELL TREATING INDUSTRIAL WASTEWATER

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**ABSTRACT:** A major challenge for the 21st century will be the efficient use of all the available resources to minimize wastage and effective methods for recycling and reuse of those resources. Lack of fresh water is becoming one of the largest and most universal of the resource problems that we face in our day today life. This leads us to consider the options for turning wastewater into useful resources, with recovery of the water for reuse. Therefore, wastewater has become an essential component in the water resources and environmental management framework. The amount of increase in manufacturing of automobiles, metal processing, food processing, textiles, leather and other various products sectors has led to requirement of huge need of fresh water for process and process support. In particular, the physico-chemical characteristics of the industrial wastewater such as pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), soluble chemical oxygen demand (SCOD), total chemical oxygen demand (TCOD), total suspended solids (TSS) is tested in the college laboratory itself and based on the output characteristics of sample, the amount of power generation from the sample to be determined. The MFC is fabricated and wastewater is fed through the inlet port of the MFC. The MFC will be operated at different organic loading rate (OLR) and the maximum power density, corresponding columbic efficiency achieving rate will be determined while treating the industrial wastewater. The treated wastewater characteristics will be monitored and the level of improvement of quality from raw effluent to treated effluent will be determined. It will be made sure that the treated wastewater characteristics shall meet the effluent discharge quality standards.

**Keywords:** *Microbial Fuel Cell (MFC), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Soluble Chemical Oxygen Demand (SCOD)*

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## MODELLING CORROSION CURRENTS OF REINFORCED CONCRETE USING ANN

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**Abstract:** The present study focuses on evaluating the corrosion performance characteristics of steel embedded in concrete, in which Manufactured Sand (M-Sand) is used as a partial and full replacement for natural sand. Corrosion performance of steel that is embedded in concrete are analyzed by impressed voltage test for M30 grade concrete replaced with 60% manufactured sand for river sand which is found optimum. The corrosion currents are modeled using feed forward Artificial Neural Networks (ANNs). The obtained results were then compared with the modeled ones in terms of Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE) and correlation coefficient criterion. The test results exhibits that the durability property of concrete against the effect of corrosion is reduced considerably, for the partial replacement of river sand with 60 % M-Sand for the selected grade of concrete. Accurate modeling results for corrosion currents was obtained using Artificial Neural Network (ANNs). The test results exhibits that ANN modeling produced close prediction current values to that of experimental results.

**Keywords:** *Manufactured Sand, Corrosion Current, Artificial Neural Network*

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## FLEXURAL AND SHEAR BEHAVIOURAL STUDY OF RC BEAMS RETROFITTED WITH GFRP

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**ABSTRACT:** Retrofitting is becoming an inevitable technique for the existing buildings to cope up with the code provisions and additional strength requirement. Though many structures were retrofitted with the conventional method, introduction of FRP (Fibre Reinforced Polymer) into it makes it more reliable, effective and faster than other methods irrespective of the different functions of the elements of the structure. Among the different types of FRPs, the use of GFRP (Glass Fibre Reinforced Polymers) has more interest among the researchers due to their admirable structural properties. In this study, an experimental behavioral study of RC beams under flexural and shear, retrofitted with FRP for these 8 beams were casted and retrofitted for flexural and shear separately and tested. The test results were compared with the control beam and notable conclusions were listed and discussed.

**Keywords:** Retrofitting of RC beams, GFRP, Flexural strengthening, Shear strengthening

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## RETROFITTING OF RC BEAMS USING VARIOUS FRPS STATE-OF-THE-ART REVIEW

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**ABSTRACT:** FRP are being used extensively in the rehabilitation and retrofitting of existing structures which are in seismic zones so, they act as an external strengthening material because of their properties like high strength to weight and corrosion resistance, light weight and high durability. This paper deals with comparative study on different types of fibre reinforced polymers like Glass Fibre Reinforced Polymers (GFRP), Carbon Fibre Reinforced Polymers (CFRP), Aramid Fibre Reinforced Polymers (AFRP), Textile Fibre Reinforced Polymers (TFRP), Woven Roving Fibre Reinforced Polymers (WFRP), Natural Fibre Reinforced Polymers (NFRP) and steel fibre reinforced polymers (SFRP).also the suitability of the various FRPs for the different performance requirements such as flexural, shear, torsion and combined forces.

**Keywords:** FRP Retrofitting, GFRP, CFRP, TFRP, AFRP

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## DYNAMIC BEHAVIOUR OF SANDWICH CONCRETE CYLINDRICAL SHELLS UNDER FREE VIBRATION

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**ABSTRACT:** Shell elements are adopted for several structural elements due to their versatile application. In particular cylindrical shell elements are used commonly for many purposes whose predominant stress will be membrane stress. The properties of the concrete cylindrical shell can be improved by introducing a basalt fiber in concrete. This paper concentrates on a parametric study of free vibration analysis of concrete, basalt fiber reinforced concrete and sandwich-type cylindrical shell. The natural frequency creates resonance when it combines with earthquake frequency. The change in base frequency can be achieved by changes in material properties. Modification of properties can reduce the resonance effect. Vibration analysis is carried out to determine the natural frequency of the shell element using finite element software ANSYS workbench'18.

**Keywords:** *Vibration Analysis, Resonance Effect, Sandwich-Type Cylindrical Shell*

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## MECHANICAL PROPERTIES OF VERY HIGH VOLUME FLY ASH CONCRETE WITH POLYPROPYLENE FIBER

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**ABSTRACT:** Concrete is the broadly used and unavoidable construction material in the construction industry. The cement is the most important ingredient of concrete. Limestone is the primary source for the production of ordinary Portland cement during the production of one ton of cement roughly one ton of carbon dioxide released to the atmosphere, which is a menace to environment. Also, the concrete is relatively strong in compression and weak in tension as well as brittle in nature. To address the above two problem, the concrete is investigated with very high volume fly ash and polypropylene fiber. This paper aims to present the effect of polypropylene fiber on very high volume fly ash concrete with various proportions. To achieve this aim the very high volume fly ash concrete samples were prepared and tested at various ages 7, 14, 28 and 60 days. An experimental test were carried out to explore the effect of polypropylene fiber on very high volume fly ash concrete such as compressive strength, split tensile strength and flexural tensile strength. The results revealed that the split and flexural tensile strength of very high volume fly ash concrete with polypropylene fiber was significantly increased in the maximum range of 30-45% when compared to conventional and very high volume fly ash concrete.

**Keywords:** Very High Volume Fly Ash Concrete, Polypropylene Fiber, Tensile Strength, Flexural Strength, Mechanical Properties

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## EXPERIMENTAL STUDY ON UTILIZATION OF SUBWAY SPRING WATER FOR DOMESTIC PURPOSES

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**ABSTRACT:** Few millilitres of water are itself made up of billions of molecules. Each molecule is made of one oxygen and two hydrogen atoms held together by strong covalent bonds. Water on our planet flows as liquid in rivers, streams, and oceans; as solid in ice at the North and South Poles; and as gas (vapour) in the atmosphere. Water is essential for human being. Our body consists of 60 % of water. Water is "used from any combination of domestic, industrial, commercial or agricultural activities, surface runoff or storm water, and any sewer inflow or sewer infiltration". This paper intends to Ashok Leyland to provide an overall vision of usage of spring water as in different domestic applications. The present short review shows use of spring water from subway for domestic applications Spring water used in Ashok Leyland for washing machine, cooling towers for Engine testing and drinking water applications by taking input of raw water. The spring water collected that is been directly pumped to storm water line for the filtration and purification purposes. Spring water quality tested by (Total dissolved solids, Hardness, pH) by third party laboratory as per IS 10500:2012 tested water are within its permissible limits. Based on the above mentioned laboratory report, the spring water used for our domestic application and reduces raw water consumption.

**Keywords:** Spring Water, Filtration, TDS, pH & Hardness

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## STUDY ON FLEXURAL BEHAVIOUR OF SUSTAINABLE CONCRETE WITH GRAPHENE AND CACTUS EXTRACT

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**ABSTRACT:** This experiment highlights the salient features of concrete under nanotechnology. Concrete production requires huge amount of cement and aggregates which eventually increases carbon emission and contaminates environment. Hence, incorporation of 'F' class fly ash partially replaced for cement, aggregate and cactus extract can be done which can reduce carbon emission and cost. However, incorporation of fly ash in ordinary Portland cement deviates its strength consequently. Hence, Graphene can be added as an additive to fill up the deviation, thereby increasing its workability and improving strengthening factor of concrete. In this mineral admixture such as Graphene were used to increase the strength of concrete and natural polymer substances such as cactus extract is used to increase the workability of concrete. For the binding material cement is replaced with the fly-ash with the percent of 30%, 40% and 50% respectively. In the investigation three specimen were casted say conventional, replacement of 30%, replacement of 40% and replacement of 50% and result of compressive and flexural strength were compared. The aim of this experiment is to maintain the economy and environmental effect.

**Keywords:** Graphene, Cactus Extract, Compressive Strength, Flexural Strength, Aggregate, Sustainable Concrete and Fly-ash

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## STATIC PUSHOVER ANALYSIS AND PERFORMANCE EVALUATION OF RC FRAMED STRUCTURES USING OPENSEES

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**ABSTRACT:** Engineering structures are very difficult to analyze for their dynamic or vibration behavior since they are very complex. In the last couple of decades alone in India, with the incidental loss of life and property witnessed due to failure of structures caused by earthquakes, now attention is given to neglect the adequacy of strength in RC framed structures to resist strong ground motions. To determine structural response beyond yield point, out of two types of nonlinearity material and geometrical. As such, nonlinear analysis can play an important role in the analysis and design of new and existing buildings. In the present paper, studies on RC Framed structures with column support shear walls has been carried out. Initially shear walls are used in reinforced concrete building to resist wind force. Since building with shear wall gives excellent performance even under seismic force, shear walls are extensively used for all earthquake resistance design. Shear wall impart lateral stiffness to the system and also carry the gravity load. When design for wind loading, the location of shear wall in building plan does not play important role. In case of Seismic loading, location of shear walls plays a critical role. Under wind loading, a fully elastic response is expected, while during strong earthquake significant inelastic deformation are anticipated. Hence, in this paper, Column support Shear walls are placed at different locations in RC frames of G+6 Storey building and analyzed for seismic action and also subjected to static pushover analysis and observed the seismic performance parameters such as storey drift, storey shear, base shear, top displacement and peak ground acceleration of the structures using OpenSEES. This paper aims to find the optimum location of shear walls which can be determined with the help of seismic performance parameters. The torsional effects in a building can be minimized by proper location of vertical resisting elements and mass distribution. Shear walls should be employed for increasing stiffness where necessary and be uniformly distributed in both principal direction. Multi-storied RCC building shear walls are now fast becoming as popular as an alternate structural form for resisting the earthquake force. Civil Engineering structures are designed to withstand environmental forces like earthquake, along with gravity loads. These forces are random and dynamic in nature. Therefore the response of the structure is also dynamic and that is what causes the unsafe and uncomfortable conditions. So, performance based analysis of the structure is required which can be achieved by Static Pushover Analysis (SPA) in OPENSEES. From the static push over analysis, graph

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of base shear to top displacement is plotted. From the graph, base shear capacity of the building is to be found out.

**Keywords:** *Base Shear, Open SEES, Seismic Performance Evaluation, shear walls, Static Pushover Analysis*

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## IMPLEMENTATION OF SUSTAINABLE CONCRETE WITH GRAPHENE AND CACTUS EXTRACT ON COLUMN USING NANOTECHNOLOGY

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**ABSTRACT:** The new dimension in the construction world is nanotechnology. The development in the field of nanotechnology gives an advantage of developing cementitious materials at nano scale. This experimental work is completely based on nano technology and came up with the idea of introducing nano particles in the raw materials used for construction. While, during the production of cement, carbon dioxide is released in enormous quantity which pollutes the environment. Hence fly ash is used as a partial replacement for cement and cactus gel can be used with water which can reduce carbon emission and cost. This paper aims to investigate the effect of Graphene on fly ash concrete and to find out the optimum quantity of Graphene in fly ash concrete required to achieve maximum compressive, tensile and flexural strength of concrete. Graphene oxide was added to the concrete in various proportions with replacement of cement by fly ash up to 40%. To achieve the aim, all the specimens were prepared and tested at various ages for the period of 7, 14 & 28 days. Test results indicated that the inclusion of Graphene in concrete enhanced the compressive, split tensile and flexural strength.

**Keywords:** Fly Ash Concrete, Graphene Oxide, Cactus Gel, Compressive, Tensile Strength, Flexural Strength

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## HAND GESTURE CONTROLLED CONSTRUCTION EQUIPMENT- A TRAINING SIMULATION MODULE

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**ABSTRACT:** Construction equipment is the major resource for completing the project. In order to perform the given work task, a well-trained or skilled laborers are required. The laborers are trained by traditional techniques to enhance their skill, to carry out the given tasks without any damages. While training the new recruits, there are many factors that are involved such as training risks, cost, impact on productivity, etc. Now a day's new technologies are developed and implemented in the field. The equipment is also operated with the help of advanced sensors, this smart technology helps in the operation and control of the various types of equipment for the effective completion of project work. Which makes sure it is safe, and efficient while using it in the industry. In this research, it is proposed that the equipment is operated with the help of hand gestures. The equipment which is to be used in this thesis work is the excavator. That will be modeled using 3D model software and the same is simulated with the help for 3D development software and then the hand gesture to be used is correlated or integrated with the equipment, which leads to a better understanding of the work system for the labors to operate. This work module is then given to the organizations for its feedbacks and suggestions to know how far this can be implemented in real-time projects. It is then analyzed and compared with the traditional techniques, in order to know its pros and cons.

**Keywords:** *Simulation Module, Hand gesture, Construction equipment, and Labor training*

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## EXPERIMENTAL STUDY ON STRENGTH AND DURABILITY PROPERTIES OF GEOGRID GEOPOLYMER CONCRETE MEMBERS

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**ABSTRACT:** The major problem we are facing today is the environment pollution. In construction industry mainly the production of Portland cement will cause the emission of pollutants results environmental pollution. Geo polymer concrete is an alternative material for conventional concrete to produce the geo-polymer concrete the Portland cement is fully replaced with GGBS (Ground Granulated blast furnace slag) and alkaline activator solution. The alkaline liquids used for the polymerization are the solutions of Sodium Hydroxide (NaOH) and Sodium Silicate (Na<sub>2</sub>SiO<sub>3</sub>) in ratio 1:2.5. Geo grid is a geo synthetic material made from polymers such as polypropylene or polyester and used as reinforcement in construction works and commonly used to reinforce retaining walls as well as subsoil below roads or structures. Geo grids are strong in tension. Compressive strength, flexural strength and split tensile strength of conventional M20 Concrete and Geo grid Geo polymer concrete members are tested and compared. Geo grid GPC beams are compared with conventional reinforced concrete beam of M20 grade of beam size 1000mm x150mm x 150mm. The flexural test is done on loading frame and the ultimate load, cracking load and maximum deflection are determined. The experimental study gives clear conclusion on the flexural behavior of conventional reinforced concrete beam and Geo grid Geo polymer concrete beam and compared.

**Keywords:** Industrial By-Products , Geo Grid Geo Polymer Concrete, GGBS, Alkaline Liquids

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## AN APPROACH TO AUTOMATED PROCUREMENT SYSTEM FOR CONSTRUCTION COMPANIES

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**ABSTRACT:** In the modernized world, a lot has turned out to be possible with the help of processors which enhance human comfort to a wider extent. The Tendering process holds numerous complex problems, including high time consumption during the assessment of the tender application forms and high-cost expense due to the preparation of tender notice and inappropriate evaluation of the eligible supplier due to exhaustion on analyzing several application forms. These issues can be minimized by replacing the conventional tendering method with the electronic tendering system. This paper illustrates the significant fundamental factors considered during the supplier evaluation process and the adoption of a website based tendering system. Furthermore, the findings will help to speed up the tendering process, reduce the cost of processing and standardize the evaluation of tenders.

**Keywords:** Procurement, Supplier Evaluation, Electronic Tendering System, Web-Based Tendering System

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## STRENGTH AND DURABILITY PROPERTIES OF VERY HIGH VOLUME FLY ASH CONCRETE WITH POLYPROPYLENE FIBER

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**ABSTRACT:** Concrete is the most widely used and unavoidable construction material in the construction industry. The ordinary Portland cement is the most important ingredient of concrete. Limestone is the primary source for the production of ordinary Portland cement. During the production of one ton of cement roughly one ton of carbon di oxide released to the atmosphere, which is a menace to environment. Also, the concrete is relatively strong in compression and weak in tension as well as brittle in nature. To address the above two problem, the concrete is investigated with very high volume fly ash and polypropylene fiber. This paper aims to present the effect of polypropylene fiber on very high volume fly ash concrete with various proportions. To achieve this aim the very high volume fly ash concrete samples were prepared and tested at various ages 3, 7, 14, 28 and 60 days. An experimental test were carried out to explore the effect of polypropylene fiber on very high volume fly ash concrete such as compressive strength, rebound number, ultra sonic pulse velocity, sorptivity and water absorption. The results revealed that the rebound number of very high volume fly ash concrete with polypropylene fiber was significantly increased in the maximum range of 20-40% when compared to conventional very high volume fly ash concrete.

**Keywords:** Very High Volume Fly Ash Concrete, Polypropylene Fiber, Rebound Number, UPV, Sorptivity

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## METAL WORKING FLUIDS (MWFs) EXPOSURES IN MACHINING APPLICATIONS OF WORKING ENVIRONMENT

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**ABSTRACT:** Millions of workers engaged in manufacturing parts for products such as automobiles, farm equipment, aircraft, heavy machinery, and other hardware are exposed to metalworking fluids (MWFs). The oil particles suspended in the industry atmosphere can affect the health of work force. The aim of present study is to identify the group of metalworking fluids in machining applications of pristine work environment. An intensive sampling method were taken as per the NIOSH standards in personal sampler and area/field sampler at the shop of machinery shells. The quality of sample results was also compared to various international standards and guidance on the MWFs. These guidelines were mainly indicate that the MWFs as administrative controls, engineering controls (machine enclosures and mist collector), personal productive equipment (PPE), health impairments and monitoring measures. According to the international standards the MWFs field survey has been taken from the check list methods upon which suggestions and recommendations were improved from the working environment. The present work is an innovative approach to reduce the particle size ranging from 0.1 to 10 $\mu$ m and improving the work zone environment in work force.

**Keywords:** Metal Working Fluids (MWFs), Machines, NISOH standards, Particle size, work environment

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## A REVIEW ON REPAIRS AND REHABILITATION OF CONCRETE STRUCTURES BY USING ECO-EFFICIENT ALKALI ACTIVATED CONCRETE

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**ABSTRACT:** In recent year the rapid growth in research and development related to geopolymer has indicated the wide applications in field of concrete repairs and rehabilitation. This paper reviewed the current research on concrete repair materials, highlighting the properties of geopolymer material. Geopolymer are materials that have wide applications in concrete structure coating, rehabilitation and sensing due to their high chloride, sulphate, fire and freeze-thaw resistances. Coating technologies are an effective means of protecting concrete structures from chemical attack and rebar corrosion. Inorganic coatings in particular have been widely applied as anticorrosive and decorative materials for concrete and steel structures. These materials show a high long-term durability even under acid and alkali attack and at elevated temperatures. Geopolymer had good repair characteristics and shows the potential as an excellent repair material. The existing infrastructures were given a little attention to durability issues long years ago and this is one of the factors affecting the damaged concrete structures. However, the continuous development among researchers is a good opportunity to take in order to solve the current issue towards implementing sustainable and cost effective geopolymer repair material. Geopolymer also shows the ability and promoted excellent bond strength to the old concrete, environmental friendly and even cost effective.

**Keywords:** Geopolymer Materials, Concrete repair, Repairs and Rehabilitation

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## ANALYTICAL INVESTIGATION ON THE LOAD-BEARING BEHAVIOR OF HOLLOW CORE SLABS WITH DIFFERENT VOID SHAPES

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**ABSTRACT:** The Total weight of a structure is of a great importance as it directly affects the cost of the building. Slabs are the biggest and heaviest structural members in buildings. Hence, many attempts have been done to find new ways to decrease the self-weight of the slabs without highly effecting the load carrying capacity of them. One of the solutions is to use hollow core slabs as they are considered as an effective alternative to reduce the self-weight of slabs beside its many other benefits regarding the need of workman ship and cost. This paper studies the flexural behavior of reinforced hollow core slabs and the effect of voids shapes and spacing on it using the finite element analysis program ANSYS. The test specimens are of uniform size 2600x1200x140mm and same reinforcement. They consist of a solid slab acting as a reference, Group 1 consists of four hollow core slabs with different voids shapes that have the same area of 1963.5 mm<sup>2</sup>, and Group 2 consists of the hollow core slab with the voids shape that gave the best results but with different spacing between the voids. It has been found that the self-weight of the slab has reduced with about 15% and the load carrying capacity has decreased by about 50%. The use of hollow core slabs in construction will decrease the self-weight of the structure and this will directly lead to a dramatic reduction in cost too.

**Keywords:** Hollow Core Slabs, Finite Element Analysis, Ansys, Self-Weight Reduction

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## INFLUENCE OF DIFFERENT SHEAR CONNECTORS IN COMPOSITE SLAB

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**ABSTRACT:** Composite slab consist of profiled deck sheet and concrete. In recent year composite slabs are widely used in construction, which is economical. In composite slab shear connector plays the major role in bonding of sheet and concrete. In this paper an experimental program by using three dovel tailed sheet profile of 1.2x0.460x0.100m thick of slab is casted above deck sheet with two different shear connector viz. Single headed shear connector and double headed shear connector. A conventional composite slab is also casted without the shear connector. The grade of the material used for the experimental work is M25 and Fe275. From the experimental results, the performance of shear connector reducing the slip failure is determined. Also the optimum type of shear connector is designed to withstand the optimum loads and to store maximum strain energy. The Flexural failure of composite slab due to adequate shear connectors is also studied.

**Keywords:** Composite Slab, Profile Sheet, Shear Connectors, Deflection, Horizontal Shear

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## EXPERIMENTAL STUDY ON COMPOSITE BEAM IN COLD FORMED STEEL STRUCTURES

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**ABSTRACT:** Composite beam is composed of two or more dissimilar material join together to act as unit. Cold formed steel sheet are widely used in composite construction. In is paper an experimental study has been conducted with three different cold formed sheet of profile viz., Rectangular, Dowel tailed and Trapezoidal profile. The composite beam is of size 1.2 x 0.340 x 0.1m. The grade of the material used for the experimental work is M25 and Fe275. The coupon test has been conducted to determine the mechanical properties of steel sheet. The beams have been tested under four point loading. The experiment is done under static loading conditions. The optimum load carrying capacity of the beam, maximum deflection and type of failure is determined. The position of propagation of cracks is also studied. Comparative analysis has been made with three different profiles based on the type of failure and the energy stored in the member is also analyzed using Origin software.

**Keywords:** Composite Beam, Cold Formed Steel, Deflection

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## EXPERIMENTAL INVESTIGATION ON BUCKLING BEHAVIOUR OF CONCRETE ENCASED STEEL COLUMN

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**ABSTRACT:** Nowadays Composite structures are highly used in high rise buildings, since it has high load bearing capacity and some other applications. Generally Composite member may be a concrete encased one or a concrete in-filled one. The concrete and the steel specimen used in a composite column generally behaves accordingly to provide higher efficiency compared to conventional member. These systems are found to be an alternative to conventional column. Encased columns are formed by I sections or built-up steel sections surrounded by concrete. Their integral behavior provides sufficient strength and stability to the concrete system. This project presents an investigative study on the behavior of concrete encased steel built-up columns with two different configurations which includes with and without spacing between the steel back to back welded specimens. The shape of the steel specimen used is supacee which has a slightly corrugated web which itself acts as a stiffener and also provides a good bond behavior between concrete and steel. The principle aim of this research is to gain an improved knowledge on the behavior of concrete encased built-up steel composite columns. This paper includes the analytical and experimental research works conducted on the buckling behavior of the encased column with respect to load and deflection.

**Keywords:** *Buckling, Encased, Column, Stiffener, Supacee*

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## EFFECT OF INCREASE IN METAKAOLIN AND NAOH CONCENTRATION ON FLYASH BASED SCGC

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**ABSTRACT:** The analysis intends to investigate the effect of an increase in Metakaolin and NaOH concentration on Flyash based SCGC. Different mechanical properties like compressive strength, shear strength and impact strength were studied by replacing fly ash for metakaolin by 0 percent, by 10 percent, by 20 percent and by 30 percent by using alkali solutions such as sodium hydroxide and sodium silicate in the ratio 1:2.5 for different NaOH molarities like 8M, 10M and 12M. Okamura method of mix design was used and then a system of trial and error was employed to achieve the SCGC mix ratio by conducting workability tests like slump flow, T-50 slump flow, V-funnel test and L-box test as per EFNARC guidelines. And after achieving the required flow the concrete was poured into the respective moulds and was cured for 24 hours in the oven at 70° C, and environmental healing is accompanied for rest of the test days. The experimental result showed that slump flow and L-Box decreased with increased molarity and metakaolin content and T-50 slump flow and V-funnel increased with increased molarity and metakaolin content. Mechanical properties such as compressive strength, shear strength and impact strength decreased with increase in metakaolin content and increased with an increase in molarity. Metakaolin replacement by 30% resulted in the lowest compressive strength regardless of any molarity and 12 M NaOH concentrations showed better strength compared to 8M and 10M concentration. Hence SCGC can be a better replacement for normal OPC concrete with reduced CO<sub>2</sub> emission.

**Keywords:** Self-Compacting Geo polymer Concrete (SCGC), Metakaolin (MK), Flyash (FA), Molarities (M), Manufactured Sand (M- Sand), Super Plasticizer (S.P)

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## DESIGN PRINCIPLES OF RESIDENTIAL COMPLEX (G+2)

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**ABSTRACT:** Structural Analysis is a branch which involves determination of behavior of structures in order to predict the responses of real structures such as buildings, bridges, trusses etc. Structural engineers are facing the challenge of striving for the most efficient and economical design with accuracy in solution, ensuring that the final design of a building must be serviceable for its intended function over its design lifetime. This project attempts to understand the structural behavior of various components in the multi-storeyed building. Thus, the residential building consists of G+2 storeys with a build-up area of 1032 sq.ft. The structure is analyzed by non-linear static analysis using STAAD PRO Vi8 software and the plan is drafted by AUTOCAD 2010. Dead load, Live load, Wind load, Seismic load and Lateral load is manually designed as per the Indian Standard codes (IS 1893 Part-1: 2002). Footings are designed based on Safe Bearing Capacity of soil. Design of Columns, Beams, Slabs, Footings and Staircase is manually designed as per the Indian Standard codes (IS 456-2000) and SP16. From the slabs, the loads are transferred to the beams, thereafter, the loads from the beams are taken up by the columns and then to the footings. The section is checked for the components manually, using STAAD PRO software for the post analysis of structure; maximum shear force, bending moment and storey displacement are computed.

**Keywords:** Computed Aided Design, Structural Analysis and Design, Dead Load, Live Load, Earthquake Load

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## DURABILITY CHARACTERISTICS OF BIOPOLYURETHANE MODIFIED CONCRETE

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**ABSTRACT:** Concrete was considered to be a very durable material with little or no maintenance, except when it is exposed to highly aggressive environments. Durability of cement concrete is defined as its ability to resist weathering action, chemical attack, abrasion or any other process of deterioration. Polymers are added during the process of mixing the concrete to modify the properties of hardened concrete, to improve durability and resistance to aggressing fluids. Biopolyurethane in the powder form was used as a polymer in the concrete. 2.5% and 5% Biopolyurethane was added to the concrete during mixing. Durability characteristics of this polymer modified concrete were assessed through conducting few durability tests at 28 days and 90 days.

**Keywords:** Polymer Modified Concrete, Biopolyurethane

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## DEVELOPMENT OF SELF CURING LIGHT WEIGHT CONCRETE USING LIGHT EXPANDED CLAY AGGREGATE (LECA) & CRYSTALLINE ADMIXTURE (CA)

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**ABSTRACT:** Quite a lot of innovations in new types of concrete have been turned up worldwide to address the unique needs of the construction industry. Several new and innovative materials such as chemical admixtures, mineral admixtures and eco-friendly binders are being used to impart required quality to concrete to satisfy the needs of the construction industry. Apart from using these materials, it is essential to ensure proper compaction and curing to achieve high strength and durability to the concrete. The conventional methods of compaction such as hand rodding and mechanical vibration are used. These methods require more man power and time for construction and also may not be effective in structures congested with reinforcement. In order to make concrete with better surface finish, improved strength and durability, it is essential to impart self-compacting ability to concrete. Apart from compaction, curing is also equally important to achieve the designed strength and durability of concrete. Curing is the process of promoting the hydration of cement in the paste. Generally, curing is being done using conventional methods such as ponding, fogging, sprinkling and covering with saturated materials etc. These methods are seldom labour intensive, time consuming and expensive. Also, negligence in curing, paucity of water in arid areas, inaccessibility of structure and presence of contaminant are some of the reasons for promoting self-curing concrete. Curing compounds such as wax emulsion, acrylic emulsion, and chlorinated rubber based compounds; hydro carbon resins and polyvinyl acetate based compounds can also be used in the concrete to promote self-curing. These chemical compounds absorb water from atmosphere to promote hydration in concrete. However, there is a need to search for cost effective solutions to impart self-curing ability to concrete. Hence, an attempt has been made in the present work to study the suitability of Light Expanded Clay Aggregate (LECA) and Crystalline Admixture (CA) as a self-curing agent (by replacing coarse aggregate partially) and also to evaluate the effect of these materials on strength, durability and flexural behavior of Self-Compacting Self Curing Concrete (SCSCC).

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**Keywords:** *Light Expanded Clay Aggregate (LECA), Crystalline Admixture(CA), Self-Compacting Concrete (SCC), Control Mix (CM), Ordinary Portland Cement (OPC)*

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## EXPERIMENTAL STUDY ON BACTERIAL CONCRETE AND IMPACT ON POLYPROPYLENE FIBER REINFORCEMENT

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**ABSTRACT:** In today's world concrete plays a vital role in major buildings. Due to severe exposure conditions concrete structure requires maintenance. Most of the structures are damaged due to formation of cracks which may be due to different parameters. One of the techniques used to prevent the cracks is by using Biological Concrete. Different types of bacteria are used in concrete construction namely *Bacillus pasteurii*, *Bacillus sphaericus*, *Bacillus megaterium*, *Bacillus subtilis*, In this investigation two types of concrete was used which consist of *bacillus megaterium*( $30 \times 10^5$ cfu/ml) and *bacillus megaterium*( $30 \times 10^5$ cfu/ml) with poly propylene fiber (2%). Both the analytical and experimental work was done to check the behavior of bacterial concrete in curing of pours in the structure and to check the bonding properties with the utilization polypropylene fiber in the bacterial concrete. Analytical work (ANSYS) shows the improvement in flexural behavior by 20% in the case of bacterial concrete and 22% in the case of bacterial concrete with polypropylene fiber compared to conventional concrete. Experimental work shows the increase in flexural behavior by 15% and 18% respectively. Beam with *bacillus megaterium* and polypropylene has shown a better behavior in various fields of tests. The comparison of both analytical and experimental work is done and behavior of bacterial concrete was observed. It was found that the utilization of *B. megaterium* and polypropylene fiber had a positive effect in improvement of structural strength.

**Keywords:** :Concrete, *Bacillus Megaterium*, Polypropylene Fiber, Flexural Behavior

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## STATIC AND CYCLIC RESPONSE OF CFRP SHEET BONDED RC BEAM WITH END ANCHORAGE

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**ABSTRACT:** The Behaviour of reinforced concrete beams strengthened with Carbon Fibre Reinforced Polymer (CFRP) sheet is presented in this paper. The experimental program includes four rectangular cross section beams of size 100\*150\*1500 mm and manufactured with M30 grade concrete and Fe500 structural steel. Over all four beams, two control and two strengthened beams, were tested under four-point bending. Two beams wrapped with CFRP sheet with end anchorage in U-Shape manner. The reinforced concrete beam has been tested and the performance under static and cyclic loading has been observed. The work carried out has examined the strengthening capacities of RC beams retrofitted with CFRP sheet is larger than the control beam. The influence of CFRP sheets was adequate on increasing the flexural strength of RC beams and the ductility of the beams was reduced. The strength gain caused by CFRP sheet in U-Shape is 12.8% in static load and 7.87% in cyclic load when compared to control beam. Experimental results show that the externally bonded CFRP sheet can increase the shear capacity of the beam significantly along with improving the performance of strengthened RC beams.

**Keywords:** CFRP, Ductility, Strengthening, RC beams, Flexural strength, Shear capacity, Static load, Cyclic load

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## DESIGN AND ANALYSIS OF STORAGE SHED FOR LPG BOTTLING PLANT

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**ABSTRACT:** Long Span, Column free structures are the most essential in any type of industrial structures and to fulfill this requirement along with reduced time and cost as compared to conventional RC structures. It involves in the storage of the bottling plant for loading and unloading of the cylinder. The present work involves the comparative study and design of steel structures. Design of the structure is being done in Staad Pro software and for the same reduction in the Z section purlin has been identified and experimental setup for the folded and welded connection, with stiffener and without stiffener and is then compared with in terms of weight which in turn reducing the cost. Here the welded section purlin with stiffener one is efficient and it withstand more load compared with folded purlin. In the present work, Conventional steel frames structure is designed for wind and seismic forces. Wind analysis has been done manually as per IS 875 (Part III) –2015.

**Keywords:** Conventional steel structures, Staad pro software section purlin test, with stiffener and without stiffener initial test, reduce the cost

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## REPAIR AND STRENGTHENING OF RC STRUCTURAL ELEMENT BY DISTRESS UNDER DIFFERENT ENVIRONMENTAL CONDITION

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**ABSTRACT:** Reinforced concrete structural elements are damaged due to various environmental effects which need to be repaired and strengthened by various methods to avoid failure. The present work is an experiment of retrofitting the distressed RC Members by using polyester resin. In this experiment, 8 beams of size with width 100mm, depth 150mm and length of 1500mm was cast and cured for 28 days. Out of 8 beams, 2 beams are control beams and the other 2 beams are loaded up to service load under four-point flexural loading. The micro cracks developed in the beam was repaired using polyester resin with 2% catalyst and 2% accelerator was mixed by bonding technique. The other 2 beams which are loaded up to ultimate load under four-point flexure was repaired using patching and overlaying technique. In this 1.2% catalyst and 1.2% accelerator was used with the polyester resin and resin concrete for cracks and damaged area. The other 2 beams are subjected to corrosion and repaired using polyester resin concrete. After testing the 2 control beam has an flexural strength of about 45KN and the other 2 beams which are repaired using bonding technique is found to be increased in strength by 10 KN and the 2 other beams repaired using patching and overlay are found to be increased in strength by 15 KN than the ultimately loaded beam. The beam with corrosion was repaired by removing the cover concrete of the beam up to the reinforcement level, then cleaned by anticorrosive chemical. Additional reinforcement required was added and tied with the existing reinforcement. Then repaired by polyester resin concrete mix and found to have flexural strength of about 65 KN. This paper presents the mechanical properties of polyester resin repair methods and flexural behavior of control and repaired beams.

**Keywords:** Beam, Concrete, Fly Ash, Polyester Resin, Compressive Strength, Flexural Strength, Repair, Reinforcement, Tension, Steel, Concrete

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## REPAIR OF STRUCTURE CRACKS BY USING LATEX MODIFIED CEMENT BASED GROUTING MATERIAL

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**ABSTRACT:** The existing cracks in the structure are studied and proper selection of grouting material is evaluated by the test on different proportions of grout mix. The pervious concrete which has a voids similar to cracks in the structures are used in the experiment for the comparative study on proportions of grout mix injected into the voids. This research work has the aim to determine the suitable grout mix with strength and durability properties and to be used in repair of existing cracks. The pervious concrete of mix proportion of 1:3 with one part of cement and three parts of coarse aggregate are taken and specimens of cube, cylinder and prism beam are casted. And the specimens are injected by grout mix formulated with different proportions of silica fume (0%, 5%, 10% & 15%) and powder form penetron latex (0%, 5%, 10% & 15%) by weight of cement is taken. These materials provide additional properties to grout. In the test G3 mix shows higher strength in compression, split tension and flexural strength properties.

**Keywords:** Pervious Concrete, Penetron Latex, Grout, Injection

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## AN EXPERIMENTAL INVESTIGATIONS ON THE PARTIAL REPLACEMENT OF FINE AGGREGATES BY PET PLASTIC WASTE IN CONCRETE

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**ABSTRACT:** Concrete is a combination of cement, aggregates and water. Due to enormous growth in concrete, aggregates are facing crisis. Apart from this, growth of plastic has provoked the methods to solve environmental issues caused by plastic. The objective of this research is to investigate the effectiveness of using waste plastic as fine aggregate replacement in concrete mixtures. The compressive, tensile and flexural strengths of various concrete specimens were tested to determine how the incorporation of recycled plastic as a replacement for fine aggregate would affect the development of strength in the mixes. The strength properties of M40 grade concrete are studied with different plastic percentage proportions. The various plastic proportions are 5%, 10%, 15% & 20% by weight. The strength properties of these mixes are studied. It is noted that there is decrease in compressive strength when the ratio of plastic to aggregate was increased. The mix for which compressive strength was least, taken and enhanced it by silica fume of 5%, 10% & 15% by weight of cement. The strength properties were again studied and the results were compared.

**Keywords:** PET, Plastic Waste, Silica Fume, M sand, Compressive Strength

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## STRENGTHENING OF COMPRESSION MEMBER BY FERROCEMENT WITH HIGH PERFORMANCE MORTAR - JACKETING TECHNIQUE

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**ABSTRACT:** External confinement using Jacketing technique can suitably use for increasing the Axial and shear strength of RC square Column. This paper encompasses an experimental and analytical investigation for studying the effectiveness and suitability of high performance ferrocement mortar mixes as a retrofitting material and its use as jacket for square columns. The experimental programme included development of high performance ferrocement mortar mix by adding 10% of silica fumes and 1% of super plasticizer and its use in retrofitting of square column specimens which were either intact or distressed earlier to certain level. The experimental programme consisted of testing 2 controlled specimens and 6 retrofitted specimens initially distressed to 80–85% of theoretical stress level, repairing, and retrofitting prior to testing. The control specimens were of dimension 100mmx100mm and 500mm height, cast in M30 conventionally vibrated concrete, reinforced longitudinally with four bars of 8 mm diameter and six lateral ties of 6 mm diameter as transverse reinforcement. Three different mixes proportions of 1:1.5, 1:2, 1:3, were used for jacketing around the columns. The jacket was reinforced with mild steel welded wire mesh 50 mm x 50 mm made of 1.16 mm diameter wire. The retrofitted specimens were tested after 28 days of curing. And then the results are interrupted.

**Keywords:** Column, Reinforcement, super plasticiser, Welded wire mesh, Ferrocement, Ultimate load carrying capacity

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## STRENGTHENING OF RC BEAMS IN FLEXURE USING FERROCEMENT

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**ABSTRACT:** Ferrocement is a thin, versatile construction material, with several unique properties and suitable for wide range of applications in Civil Engineering. The purpose of this study was to check the strength, deflection and crack pattern of ferrocement beam specimen. The prefabricated elements made of reinforced concrete are extremely heavy and difficult to transport, placing in position and to construct. Because of its good structural performance and low cost ferrocement is used in construction industry. So finding the flexural behavior of ferrocement is necessary. The results show that the flexural strength and ultimate load carrying capacity of the ferrocement beam. Strengthening of the beams by using Ferro-mesh layer is not only easy to implement at household level, but is also promising in terms of enhancing load carrying capacity, stiffness and ductility.

**Keywords:** Ferrocement, Ferro-mesh, Flexural Strength, Ultimate load carrying capacity

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## FEA OF DIFFERENT SHEET PROFILES EFFECT ON CONVENTIONAL CONCRETE COMPOSITE SLAB

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**ABSTRACT:** The steel-concrete composite deck slab is an effective flooring option all over the world since last five decades and had become preponderant in modern constructions due to higher structural performance with minimum utility of materials, Composite deck slab comprise of two parts first is concrete slab and second is cold form profile steel sheet, This research conduct an analytical study to evaluate and comparison of the flexural strength using three standard type of sheet profiles(P1, P2, P3), Three types modeled using Finite elements (FE) software ABAQUS program of uniform size 1400mm\*1400mm\*150mm in addition of Conventional Concrete Slab (CCS) the results shows that Composite slab using profile sheet type 2 and type 3 has slightly same load carrying capacity but higher than type 1, also it give a clear concept about effecting of adding the sheet profile to the conventional concrete slab performance in term of flexural strength and deflection.

**Keywords:** Composite slab, sheet profile, Finite elements analysis (FEA), flexural strength

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## EXPERIMENTAL INVESTIGATION ON STRENGTH CHARACTERISTICS OF GRAPHENE CONCRETE

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**ABSTRACT:** Graphene Oxide is typically produced via the chemical oxidation and exfoliation of graphite. Graphene Oxide is a recently invented 2D Nano plane fiber. The hydration properties of Graphene Oxide-cement composites have been found to result in a higher hydration rate, which affects both the water demand and workability of the composites. It contains active functional groups on its nano plane surface, and these groups play a major role during the cement hydration process. Based on the literature survey some authors have also reported that reinforcing the cement matrix with Graphene Oxide results in the formation of calcium silicate hydrate gel in the micropores, thereby enhancing the resultant composite's mechanical properties. Markedly few studies have examined the durability of Graphene Oxide-cement-based composites. In this project work Graphene Oxide, which is used in the partial replacement of cement is 0.1%, 0.3% and 0.5% to produce a better performance concrete. The various tests like compression, split tensile test were done in order to compare the mechanical properties with conventional concrete.

**Keywords:** 2D Nano plane fiber, Calcium Silicate Hydrate, Graphene Oxide (GO)

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## AN EXPERIMENTAL STUDY ON MECHANICAL BEHAVIOUR AND CHARACTERISTICS OF POLYMER MODIFIED CONCRETE WITH PARTIAL REPLACEMENT OF GLASS POWDER AS FINE AGGREGATES

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**ABSTRACT:** This study represents the comparison of mechanical properties of the concrete modified with polymer and partial replacement of glass powder as fine aggregate with conventional concrete. Polymer concrete provides many advantages like high resistance to impact, freezing and thawing, chemical attacks and abrasion when compared to normal conventional concrete. Polymer concrete can be used mainly for floor surfaces subjected to high loads and wear, dam structures, bridge decks, high load bearing walls, etc. The trial mixes involves replacement of cement by 5%, 10%, 15% of acrylic polymer and fine aggregates are replaced by glass powder at 20%, 40%, 60%, 80% , higher optimum compressive strength was obtained when the cement is replaced by acrylic polymer at 5% and the fine aggregates were replaced by glass powder at 20% compared to other trial mixes. By using this optimum mix a structural column is to be casted and its buckling load will be determined.

**Keywords:** Acrylic Polymer, Glass Powder, Strength, Column, Buckling Load

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## OUTLINE OF PLANNING AND CONSTRUCTION OF UNDERGROUND METRO STATION

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**ABSTRACT:** Evidently, India has been developing their infrastructure in various field which includes Power, dams, Roads and Metro Rail system. Rapid growth of Metropolis Cities has been requiring a transport system like Metros for scatter the traffic accumulation in a well-organized Pattern with stipulated time and travel. Since most of the surface land has been utilized for roads, Sub urban railway track, there is a compulsion to use the below surface for extending the Rail network as Underground Station, Tunnels and Subways. Execution of the Metro Projects in the City plays a vital role in the Country's Economy; hence it is mandatory to Ensure the Structural stability of the Metro line Effectively without compromising the Quality & Aesthetics. The main objective of the paper is to explain about Various aspects of the Underground station Construction and Methodology which have been implemented to make a safe and Cost- Effective transport. Also, it gives an Overall view of an Underground Metro Station and the relevant data interpretation which are being used for the Construction of the station building in the present projects. Systematic planning and selecting the Appropriate methodology dealing with the interface Contractors enhances the Project progress in a right way. The selection of the Top-down or Bottom -Up Methodology being done based on the Station location, Soil profile in and around the site, the availability of the resources where the depth of the station is shallow even 15- 20m from the surface then Cut-cover methodology has been used and other hand. Extremely the working space is restricted and Complex Rocky strata presence in the track line, it leads to implement the NATM (New Australian Tunnel method) or sequential Excavation method during Construction stage.

**Keywords:** *Underground station, Top-down, Bottom-Up Methodology, Permanent & Temporary Structures*

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## LINEAR ANALYSIS OF BRICK MASONRY PRISM USING ABAQUS

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**ABSTRACT:** In this study, the response of brick masonry specimen subjected to vertical loads is analytically calculated using existing formulas and numerically investigated using a popular software ABAQUS. For the analytical investigation purpose a small part of the old building which was constructed with brick masonry was taken as test specimen. It consists of three layers of brick and two layers of mortar. The height, width and thickness of the specimen is 245 mm, 220 mm, and 100 mm respectively. Macro and micro model of the specimen was developed using ABAQUS software. Vertical load from 0 to 30.0kN at interval of 3.0kN was applied on the specimen. It is very difficult to analyse for stresses of brick and mortar separately of brick masonry considering the effect of continuity of materials at the joints between brick and mortar. From the macro model deflections and stresses of brick masonry at design load were predicted and these values were compared with analytical calculations. From the micro model stresses in brick and mortar of masonry at design load were predicted independently and these values were compared with analytical calculations. It was found from the investigation, that the increase in stress and deflection are almost linear to the applied loads.

**Keywords:** Brick Masonry, Macro and Micro Model, ABAQUS

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## EXPERIMENTAL STUDY & MICROSTRUCTURAL BEHAVIOUR OF CONCRETE WITH GRAPHENE OXIDE

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**ABSTRACT:** Micro structural study on concrete is a unique technique to find out the morphological features of concrete. X-Ray Diffraction Analysis (XRD), Scanning Electron Microscope (SEM) is the general technique used to visualize the micro structural behavior of concrete during hydration process. The specific characteristics within the concrete can be visualized through these modern techniques. The mineral data obtained from the micro structural study will helps to interpret the unique behavior of concrete and presence of minor compound inside the hardened cement paste of concrete. The hydration process in concrete will leads to formation of C-S-H gel, Ca (OH)<sub>2</sub> crystals, and other mineral compounds which influences the individual properties of concrete. In this project work citric acid method, i.e, pyrolysis method is used to synthesis grapheme oxide(GO) which is later used in the partial replacement of 0.1%, 0.3% and 0.5% of cement to produce a better performance concrete This paper presents the comparative study of various of microscopic analysis of graphene concrete & conventional concrete including its effects on hydration & workability.

**Keywords:** X-Ray Diffraction Analysis (XRD), Scanning Electron Microscope (SEM), Calcium Silicate Hydrate (C-S-H), Graphene oxide(GO), Micropores

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## STRENGTH CHARACTERISTICS OF FLY ASH/ SLAG BLENDED ALUMINA SILICATE CONCRETE UNDER AMBIENT CURING

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**ABSTRACT:** Construction has been the most important human activity since ancient time. Concrete is widely used and reliable material for construction. Some of challenges in industry are global warming and insufficiency of construction material. One of the novel material which replaces to conventional concrete is the Alumina Silicate Concrete. This research article outcomes the results of an experimental investigation on strength characteristics alumina silica concrete produced with Fly ash (Class - F Grade) and GGBS (Ground Granulated Blast Furnace Slag) and alkaline activators under ambient temperature. Fly ash was partially replaced by GGBS at different replacement levels from 0 to 50% with a standard concentration of 8M and the samples are cured at ambient temperature. The main parameters of the study are strength properties such as Compressive strength, Split tensile Strength and Flexural Strength. In addition to that Water Absorption test also conducted.

**Keywords:** Fly Ash, GGBS, Geopolymer concrete, Strength parameters

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## COMPARATIVE STUDY ON DIFFERENT BRACING SYSTEMS ON A STEEL JUNCTION TOWER

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**ABSTRACT:** Junction tower is a material handling structure supporting belt conveyors and are made of steel. They are mainly subjected to lateral forces such as wind and seismic loads due to their height varying from anywhere between 20 meter to 70 meter. Hence bracings are required to resist these lateral forces. The tower considered in this study is a 24 meter tall steel structure with a plan area of 10m x 12m. The main object is to study participation of braces for different parameters such as base shear, storey forces, displacement, storey shear and storey stiffness for different bracing configurations mainly Chevron bracing, Inverted Chevron bracing, K-bracing and X-bracing. STAAD Pro. Software is used for modelling and analysing the tower. The response of the building with different bracing configuration at different locations is represented in tables and graphs which will help to understand the behaviour of the concentrically braced steel tower more accurately.

**Keywords:** Steel Junction Tower, Concentrically Braced Frames, Lateral Loads, Seismic Design

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## PERFORMANCE OF THIN-WALLED LIPPED CHANNEL SECTIONS UNDER AXIAL COMPRESSION

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**ABSTRACT:** Usage of thin-walled members for construction of residential and industrial structures is on the rise. As the thin-walled members are susceptible to different buckling modes, utilization of full capacity of the cross-sections is impossible. Towards maximize the utilization, these members are used in composite with other materials and structures. However, understanding the fundamental performance of the individual members is base line for further studies. Hence, the objective of this paper is to investigate the buckling behavior of thin-walled steel lipped channel column with the influence of imperfections. The Finite Element model is incorporated with material and geometric non-linearities. Further, it is also incorporate with geometrical imperfections through linear buckling analysis. The respective mode shapes corresponding to the local buckling and overall buckling has been incorporated with the scale factor. This is followed by non-linear buckling analysis which works based on the Riks algorithm was done to get correct and more realistic information of post-buckling response. The results obtained from the Finite Element analysis is compared with that of the experiments.

**Keywords:** Influences of Imperfections, Linear Buckling, Nonlinear Buckling, Elasto-Plastic Material Behavior, Post Buckling

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## EVALUATION OF ROAD SAFETY RATING SYSTEM

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**ABSTRACT:** The global epidemic of road crash fatalities and disabilities is gradually being recognized as a major public health concern. As per WHO, nearly 1.25 million people die each year, on average 3287 deaths per day which is 2.2% of global death rate. UN has established Sustainable Development Goal (SDG) among which road safety is also considered to be fulfilled. But as of current situation we may not achieve the target to reduce the accidents by 50%. To reduce the accidents we need to improve our road standards, for which we must know their standards. To achieve this we consider rating the roads based on their safety standards. STAR rating is a universal approach right now to rate the roads where 1 is being the lowest and of worst condition and higher rate of accidents, while 5 being the highest to get best road conditions. Various countries like USA, China, Australia and European countries have adopted this method as usRAP, ChinaRAP and EuroRAP. Even India has adopted this method but still haven't been utilised properly. It has been implemented in states of Karnataka, Andhra, Assam, Tamil Nadu, Gujarat and some places in Uttar Pradesh. This rating method uses a visual inspection at every 100m interval and these data are then correlated to its crash risk factor and rating is given to the road. The road stretch selected in this study is NH38 from Madurai to Melur. The rating for this stretch was in range of 1 or 2 star and requires attention to increase this rating to 3 star. Currently most of the highways are of only 2 star or less and must be improved to minimum of 3 stars.

**Keywords:** Road Safety, Rating System, iRAP

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## DURABILITY STUDIES ON GRAPHENE CONCRETE

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**Abstract:** Nanotechnology is emerging as an important advancement in the Material research in the Civil Engineering field. Various studies shows that Graphene, a Nanomaterial is being augmented in the different areas of Civil Engineering such as waste water treatment, concrete and construction areas, etc., Graphene being inert, its oxidised as Graphene Oxide (GO) which is recently invented 2D Nano plane fibre. GO is typically produced through the chemical oxidation and exfoliation of graphite. It contains active functional groups on its nano plane surface, and these groups play a major role during the cement hydration process. Preliminarily, the hydration properties of GO-cement composites have been found to result in a higher hydration rate, which affects both the water demand and workability of the composites. Based on the literature survey some authors have also reported that reinforcing the cement matrix with GO results in the formation of calcium silicate hydrate (C-S-H) gel in the micropores In this project work Graphene Oxide (GO) which is used in the partial replacement of 0.1%, 0.3% and 0.5% of cement to produce a better performance concrete. The various tests like Permeability test, Water absorption test were done in order to compare the durability properties with conventional concrete. This paper presents the comparative study of various durable properties of graphene concrete & conventional concrete including its effects on hydration & workability.

**Keywords:** 2D Nano plane fibre, Calcium Silicate Hydrate (C-S-H), Exfoliation, Graphene Oxide (GO), Micropores

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## ASSESSMENT OF DROUGHT CONDITION BASED ON STANDARDIZED PRECIPITATION INDEX AND SOIL MOISTURE CONDITION- A CASE STUDY IN PARTS OF CHENGALPATTU DISTRICT, TAMILNADU, INDIA

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**ABSTRACT:** The frequency of extreme weather events is expected to increase, in general, so it is imperative to focus on the studies of day to day changes in the land surface. Soil moisture plays an important role in energy balance on the surface, runoff, drought and climate change conditions. The study deals with various aspects of the soil moisture determination and its comparison between pre-monsoon and monsoon season. Rainfall data of the study area was used for computing the Standardized Precipitation Index (SPI) to determine the severity of the drought. Soil samples collected were used for performing gravimetric analysis, to identify the percentage of moisture in the soil. The spectroradiometer helps in obtaining the reflectance pattern of soil. Soil moisture sensor along with the Arduino software was used to identify soil moisture in the field. The main aim of the study is to compare the seasonal changes, to assess the precision of soil moisture. From the results, it is evident that there is a dry to a severely dry condition in the study area which indicates the onset of drought.

**Keywords:** Spectroradiometer; Soil moisture sensor; Gravimetric analysis; SPI; Drought condition

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